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The Effectiveness of Using Realistic Mathematics Education (RME)-based Students' Worksheet to Improve Students' Mathematical Problem-solving Skills

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Abstract

The achievement of this study is to evaluate how successful the Realistic Mathematics Education (RME)-based Students' Worksheets (LKPD) are in enhancing students' mathematical problem-solving abilities. This study adopts an empirical study through experimentation design using a control group with assessments before and after the intervention. The experimental group consisted of 36 students from Class X-E2, while the control group comprised 36 students from Class X-E3. Data were collected using interviews, observations, and pretest and posttest assessments to evaluate students' ability to determine solutions to problems based on statistics. The method and focus of this research is that the use of RME-based LKPD is more impactful to improving students' problem-solving skills than learning without using RME-based LKPD. The study found that using RME-based LKPD, which includes indicators focused on problem-solving skills, effectively enhances students' problem-solving abilities. The conclusion is from a large number of statistical tests: the Wilcoxon Marked Rank Test, which gives that the results for the experimental and control groups have a significance level (sig. 2-tailed) less than 0.05; The U Mann-Whitney test, which also gives a value of 2 tails less than 0.05; and the mean disparity test, which revealed an improvement in problem-solving skills of 28.05 for the experimental group was evaluated in comparison to 11.39 for the control group. These findings provide that the use of RME-based LKPD is more effective in improving students' dilemma-solving skills than not using RME-based LKPD.

Keywords: Problem-solving Ability, Learner Worksheet, Realistic Mathematics Education.

1. Introduction

Mathematics education plays an important role in shaping students' cognitive skills and analytical thinking. Ability to solve problems is a critical component of effective math learning (Siahaan & Surya, 2018). Problem-solving is an important skill that requires not only understanding of mathematical concepts, but also creativity, analytical thinking, and critical

thinking skills. In order to solve mathematical issues and apply in real life, students need to have a fundamental ability called problem-solving skills (Widyastuti & Airlanda, 2021). Problem-solving ability has indicators, comprising: (1) grasping the issue; (2) devising the plan; (3) addressing the problem; (4) reviewing the solution (Rizky & Marhaeni, 2023; Dwianjani et al, 2018).

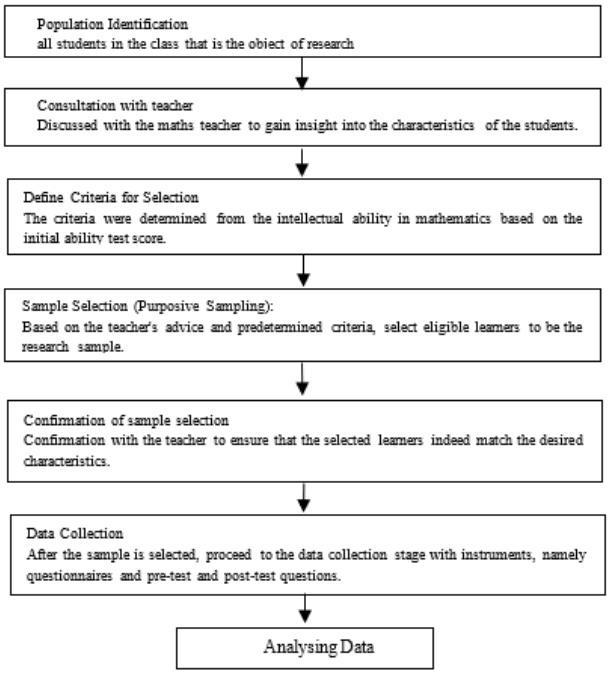
Teachers must establish an environment that supports students' comprehension of mathematical concepts and the development of efficient problem-solving techniques during the mathematics learning process (Fitrah, 2017). In facing the demands of an ever-evolving era, innovative learning approaches are key to ensuring that students can master mathematics well and be able to apply it in everyday life (Hamdaniyah, 2023). A new learning strategy called Realistic Mathematics Education (RME) places a strong emphasis on applying real-world circumstances to the study of mathematics (Nurcahyono, 2023). Through the application of mathematics to common situations, RME aims to provide students meaningful learning experiences (Ulya et al, 2019). Thus, RME not only improves the understanding of mathematical concepts, but also strengthens students' ability to solve problems by linking mathematics to everyday life.

Learner Worksheets (LKPD) have become one of the effective learning instruments in supporting the mathematics learning process (Fannie & Rohati, 2014). By utilizing LKPD, educators can design learning activities that are structured and varied, in accordance with the learning principles to be achieved (Astuti & Sari, 2017). In the context of teaching mathematics, the use of RME-based (LKPD) is one of the effective instruments in bringing this approach into the classroom (Primasari et al, 2021). By using real situations or problems relevant to everyday life, RME-based LKPDs are designed to provide students with concrete and contextualized learning experiences, thus encouraging deeper understanding and better problem-solving skills (Nisa et al, 2024; Hasanah et al, 2017)). This LKPD supports students in connecting mathematical concepts with contexts that they are familiar with.

Previous research have proven that the application of RME-based LKPD can enhance students' comprehension of mathematical ideas and problem-solving skills (Meika et al, 2023; Herlina et al, 2022). Similarly investigation is needed to thoroughly verify the effectiveness of RME-based LKPD, mainly concerning its impact on college students' mathematical problem-solving talents. In the future research, however, adjustments are needed to the curriculum applied in schools. Therefore, this take a look at pursuits to decide whether RME-based totally LKPD improves students' capabilities in fixing mathematical problems. The study will involve an experimental design where one group of students will receive learning using RME-based LKPD, while another group will receive conventional learning. Data will be collected through a test of mathematical problem solving skills and lesson observations. Therefore, it is hoped that this study's findings will not only significantly improve the creation of more efficient teaching strategies for mathematics, but also enhance knowledge of how to apply the RME strategy to support students become more effective at solving problems.. It is also expected to provide a foundation for the development of a more relevant and effective mathematics curriculum in preparing students to face future challenges.

2. Methods

This research utilizes an experimental approach, more especially, a design involving a control group with measurements taken before and after the intervention. There were two separate class used: the experimental group and the control group. The experimental class received instruction using worksheets for students grounded in practical mathematics instruction. The study population consisted of 72 students from classes X-E2 and X-E3. The sample selection was conducted using purposive sampling technique, which is the selection of subjects based on certain characteristics, such as learners with diverse intellectual abilities based on the advice of the teacher who teaches mathematics in the class. The control group consists of the class that has the highest average score, while the experimental group consists of the class that has the lowest average score. The underlying assumption of this study is that if students with lower mean scores can improve their mathematical problem-solving competence, then practical mathematics education-based totally learner worksheets will prove effective for learning purposes. Therefore, class X-E2, which showed the lowest average, became the experimental group, while class X-E3, with the highest average, became the control group. The aim of this study is to enhance the abilities of students in solving statistical problems by utilizing evaluations before and after the instruction, observations, and interviews to collect data. According to the hypothesis, using RME-based LKPD will result in more improvements in these skills than using non-RME-based LKPD. Data analysis using SPSS 26 begins with prerequisite tests, including the normality test and homogeneity test. If the prerequisite tests were fulfilled, then the data analysis continued with parametric tests, including: (1) paired sample T-test; (2) independent sample T-test; and (3) mean difference test. If the prerequisite tests are not fulfilled, then the data analysis will continue with non-parametric tests, including: (1) Wilcoxon Ranked-Signed Test; (2) Mann-Whitney U Test and (3) mean difference test. The significance level used is 0.05. The following is a research flow table:



3. Result and Discussion

The study produced the following result obtained using tools consisting of questions for both pretest and posttest assessments of mathematical problem-solving ability on statistics material. After administering the pretest and posttest questions, the researcher utilized SPSS 26 software to analyze the effectiveness of Realistic Mathematics Education-based Learner Worksheets, followed by detailing the testing procedures conducted:

Prerequisite Test Analysis

In order to conduct hypothesis testing describing the effectiveness of the product, the data collected, which includes the experimental group's performance metrics from pretest and posttest assessments and control classes, must fulfil two main assumptions: normality and homogeneity.

Table 1. Pretest and Posttest Normal Distribution Results

Data	Significance Value	Description
Experimental Class Pretest	.177	Normal
Control Class Pretest	.414	Normal
Experimental Class Posttest	.046	Abnormal
Control Classes Posttest	.000	Abnormal

The research data were examined with SPSS 26 software, using the Shapiro-Wilk normality test using a significance value of 0.05. The hypotheses in this normality test are:

H_0 : Data is not normally distributed

H_1 : Data is normally distributed

The significance value achieved must be more than 0.05 (>0.05) to assess whether the data distribution follows a normal pattern. Table 1 shows that the posttest results of the experimental and control classes are not normally distributed. This meant that H_0 was accepted.

Table 2. Homogeneity Test Results

Data	Significance Value	Category
Pretest	0,194	Homogeneous
Post-test	0,830	Homogeneous

The Levene Statistic homogeneity test was used in the homogeneity test, which was conducted using SPSS 26. The hypothesis in this homogeneity test are:

H_0 : Data is not homogeneous

H_1 : Data is homogeneous

Table 2 shows the outcomes of the homogeneity tests administered before and after to the group undergoing the experiment and the group not exposed to the experiment. Based on the requirement that the significance value be more than 0.05 (>0.05), the homogeneity of the data is ascertained. Table 2 shows that there is homogeneity in the pretest and posttest results of mathematical problem solving ability.

According to the results of the prerequisite exam mentioned above, there are anomalous but homogenous data in the pretest and posttest results for both the experimental and control classes. Thus, there was no passing score on the required exam. Hence, pretest and posttest data will be investigated using non-parametric statistical tests and mean difference tests in order to ascertain the efficacy of using student worksheets based on actual mathematics instruction.

Effectiveness Test

Wilcoxon Signed Rank Test

The Wilcoxon Signed Rank Test, a non-parametric test, assesses the average disparity among paired samples and determines if there is an effect from the treatment applied. The test was conducted using SPSS 26 software, and the results are presented below:

1. The Effect of Mathematics Learning Using Students' Worksheets on Mathematics Problem-solving Ability

   This examination utilized pretest and posttest data from the experimental group to evaluate their mathematical problem-solving skills. The test results as illustrated in Table 3 provided below:

Table 3. Experimental Class Test Results

Pretest Posttest Experimental Classes	
Z	-5,021
Asymp. Sig. (2-tailed)	0,000

Based on Table 3, since the significance level (2-tailed) is less than 0.05, it indicates that there has been an enhancement in problem-solving abilities in the experimental group both before and after the application of assessments based on Realistic Mathematics Education. (LKPD).

2. The Effect of Learning Mathematics Without Using Realistic Mathematics Education-Based Student Worksheets on Problem Solving Ability

   This analysis that is being carried out, pretest and post data are a reference of the control group to assess their problem-solving ability. The test results as illustrated in Table 4 provided below.

Table 4. Control Class Test Results

Pretest Posttest Control Class	
Z	-4,765
Asymp. Sig. (2-tailed)	0,000

Based on point 4, since the significance level (2-tailed) is less than 0.05, it indicates that there has been a notable enhancement in the control group's problem-solving abilities both before and after the introduction of learning methods without RME-based LKPD.

a. Mann-Whitney U Test

Mann-Whitney U Test is a statistical method that does not have to rely on parameter assumptions, used to identify the effectiveness of different learning approaches in enhancing students' problem-solving skills and interest in learning. This test will analyze posttest data from both the control and experimental groups. SPSS 26 software will be utilized to perform the Mann-Whitney U Test, examining the posttest results related to problem-solving capabilities. The outcomes of this test regarding problem-solving skills are shown in Table 5.

Table 5. Mann-Whitney Test Results

Post Test Results	
Mann-Whitney U Test	104,000
Wilcoxon W	770,000
Z	-6,161
Asymp. Sig. (2-tailed)	0,000

Based on table 5, it shows that sig. 2 tailed < 0.05, The conclusion that can be drawn is that students' ability to determine problem-solving solutions will increase as a result of learning using student worksheets than learning without using RME-based LKPD.

b. Average Difference Test

In addition to further to using the Wilcoxon signed rank check and the Mann-Whitney U check to assess effectiveness, a evaluation of the average improvement between the experimental institution and the control group could be made. This assessment will use the pretest and posttest data of problem fixing capacity. Table 6 presents the results of the analysis of the distinction in common improvement between the pretest and posttest ratings of trouble fixing capability:

Table 6. Statistics of Pretest and Posttest Results

Aspects	Experimental Classes	Control Classes
Grade point average	*Pretest*: 61,53 *Posttest*: 89,58	*Pretest*: 47,08 *Posttest*: 58,47
Average Increase	28,05	11,39

Table 6 shows that the control group recorded an increase in the average score of 11.39, while the experimental group had an average increase of 28.06. The results show that the experimental class experienced a greater average increase in test results than the control class. So, learning using LKPD based on Realistic Mathematic Education is more effective to improve students' problem solving ability and learning motivation.

According to the findings of the effectiveness test conducted, it can be determined that employing RME-based student worksheets enhances problem-solving skills. Figure 1 below illustrates the distinction in average improvement between pretest and posttest scores for both the experimental and control groups.

Figure 1. Average Increase Difference

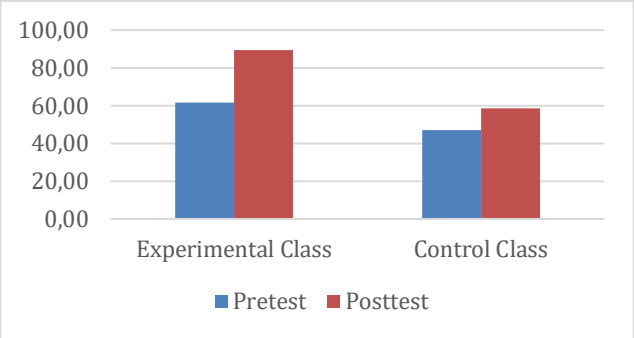


Figure 1 presented shows a significant improvement in the experimental class using RME-based LKPD. This is because the RME-based LKPD contains problem-solving indicators, namely: (a) understanding the problem; (b) plan the settlement; (c) resolving problems; (d) re-check. According to these findings, the application of RME-based LKPD effectively enhances students' problem-solving skills..

Based on Table 6 or Figure 1, conclusion drawn is that the average increase in the experimental class is greater relative to typical increase in the control class so that the use of RME-based LKPD can improve students' problem-solving skills. These findings are consistent with the research conducted by Herlina et al. (2022), which summarizes that the use of RME-based LKPD improves students' problem-solving skills. Likewise, Siregar (2021) “research stated that RME-based LKPD is quite effective in increasing students' mathematical problem-solving skills”.

In general, according to the results, the use of RME-based LKPD significantly enhances students' ability to solve mathematical problems. According to Putri's study (2021), RME-based learner worksheets are effective in enhancing students' mathematical problem-solving skills and can serve as valuable input in the mathematics learning process. In the RME-based LKPD, the questions presented are in the form of contextual and real-life problems that can stimulate students' capacity for resolving mathematical issues. In line with the research conducted by Fadilah (2018), the RME-based LKPD received a positive response from students so that the indicators or completeness of the set learning objectives were achieved. Therefore, this study concludes that utilizing RME-based LKPD in mathematics education effectively enhances students' mathematical problem-solving skills.

4. Conclusion

Based on this study, it can be concluded that using RME-based learner worksheets, which incorporate problem-solving skill indicators, significantly enhances students' problem-solving abilities. This conclusion is supported by statistical analyses, including the Wilcoxon Signed Rank Test and the Mann-Whitney U Test, both of which yielded a significance level (sig. 2-tailed) of less than 0.05. Additionally, the mean difference test revealed an increase of 28.06 in the experimental group compared to 11.39 in the control group, indicating that learning with RME-based worksheets was more effective in improving students' problem-solving skills than traditional methods.

5. References

Astuti, A., & Sari, N. (2017). Pengembangan lembar kerja siswa (lks) pada mata pelajaran matematika siswa kelas x sma. Jurnal Cendekia: Jurnal Pendidikan Matematika, 1(2), 13-24. https://doi.org/10.31004/cendekia.v1i2.16

Dwianjani, N. K. V., Candiasa, I. M., & Sariyasa, S. (2018). Identifikasi faktorfaktor yang mempengaruhi kemampuan pemecahan masalah matematika. NUMERICAL: Jurnal Matematika Dan Pendidikan Matematika, 2(2), 153– 166. https://doi.org/10.25217/numerical.v2i2.276

Fadilah, P. (2018). Pengembangan Perangkat Pembelajaran matematika Berbasis Realistic Mathematis Education (RME) Untuk Meningkatkan Kemampuan Pemecahan Masalah Pada Siswa Kelas VII SMP. Medan: Universitas Muhammadiyah Sumatera Utara.

Fannie, R. D., & Rohati, R. (2014). Pengembangan lembar kerja siswa (LKS) berbasis POE (predict, observe, explain) pada materi program linear kelas XII SMA. Sainmatika: Jurnal Sains dan Matematika Universitas Jambi, 8(1), 221053.

Fitrah, M. (2017). Pembelajaran berbasis masalah untuk meningkatkan pemahaman konsep matematika pada materi segiempat siswa smp. Kalamatika: Jurnal Pendidikan Matematika, 2(1), 51-70. https://doi.org/10.22236/KALAMATIKA.vol2no1.2017pp51-70

Hamdaniyah, N. (2023). PENGARUH, MODEL PEMBELAJARAN PROBLEM BASED LEARNING TERHADAP KEMAMPUAN PEMECAHAN MASALAH MATEMATIKA SISWA KELAS IV SDIP MUHAJIRIN (Doctoral dissertation, Universitas Islam Sultan Agung Semarang). http://repository.unissula.ac.id/id/eprint/28723

Hasanah, R. Z., Rustono, W. S., & Lidinillah, D. A. M. (2017). Desain didaktis konsep skala berbasis RME. Indonesian Journal of Primary Education, 1(1), 80-86. https://doi.org/10.17509/ijpe.v1i1.7501

Herlina, F., Yerizon, Y., Syarifuddin, H., & Fitria, Y. (2022). Efektivitas Perangkat Pembelajaran Matematika Basis RME dalam Meningkatkan Pemecahan Masalah Peserta Didik di Kelas V Sekolah Dasar. Jurnal Basicedu, 6(2), 2391-2399. https://doi.org/10.31004/basicedu.v6i2.2138

Meika, I., Solikhah, E. F. F., Yunitasari, I., & Sujana, A. (2023). Efektivitas LKPD Berbasis RME terhadap Kemampuan Pemahaman Konsep Ditinjau dari Ketuntasan Belajar. SJME (Supremum Journal of Mathematics Education), 7(2), 211-221. https://doi.org/10.35706/sjme.v7i2.9314

Nisa, U. K., Gusti, V. Y. K., & Nadiyyah, K. (2024). PENGEMBANGAN MEDIA KONKRET BERBASIS RME PADA PEMBELAJARAN BANGUN RUANG. JOURNAL OF SCIENCE AND SOCIAL RESEARCH, 7(1), 368-377. https://doi.org/10.54314/jssr.v7i1.1717

Nurcahyono, N. A. (2023). Peningkatan Kemampuan Literasi dan Numerasi Melalui Model Pembelajaran. Hexagon: Jurnal Ilmu dan Pendidikan Matematika, 1(1), 19-29. https://doi.org/10.33830/hexagon.v1i1.4924.

Primasari, I. F. N. D., Zulela, Z., & Fahrurrozi, F. (2021). Model mathematics realistic education (RME) pada materi pecahan di sekolah dasar. Jurnal Basicedu, 5(4), 1888-1899. https://doi.org/10.31004/basicedu.v5i4.1115

Putri, S. A. (2021). Pengembangan Perangkat Pembelajaran Berbasis Realistic Mathematics Education (RME) untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Peserta Didik Kelas X SMK (Doctoral dissertation, Universitas Negeri Padang).

Rizky, M. R. F., & Marhaeni, N. H. (2023). Efektivitas Penggunaan Aplikasi Pembelajaran Mathapp untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika. Paedagoria: Jurnal Kajian, Penelitian Dan Pengembangan Kependidikan, 14(3), 213-225. https://doi.org/10.31764/paedagoria.v14i3.15923

Siahaan, Y. S., & Surya, E. (2018). Analisis Kemampuan Pemecahan Masalah Matematika Siswa SMP IT Nurul Fadhila Percut Sei Tuan. Jurusan Pendidikan Matematika FMIPA UNIMED.

Siregar, S. (2021). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Realistic Mathematics Education (RME) untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Peserta Didik kelas IV SDS Muhammadiyah 1 Padangsidimpuan (Doctoral dissertation, Universitas Islam Negeri Sumatera Utara). http://repository.uinsu.ac.id/id/eprint/14361

Ulya, M. R., Isnarto, I., Rochmad, R., & Wardono, W. (2019, February). Efektivitas pembelajaran flipped classroom dengan pendekatan matematika realistik Indonesia terhadap kemampuan representasi ditinjau dari self-efficacy. In PRISMA, Prosiding Seminar Nasional Matematika (Vol. 2, pp. 116-123).

Widyastuti, R. T., & Airlanda, G. S. (2021). Efektivitas model problem based learning terhadap kemampuan pemecahan masalah matematika siswa sekolah dasar. Jurnal Basicedu, 5(3), 1120-1129. https://doi.org/10.31004/basicedu.v5i3.896